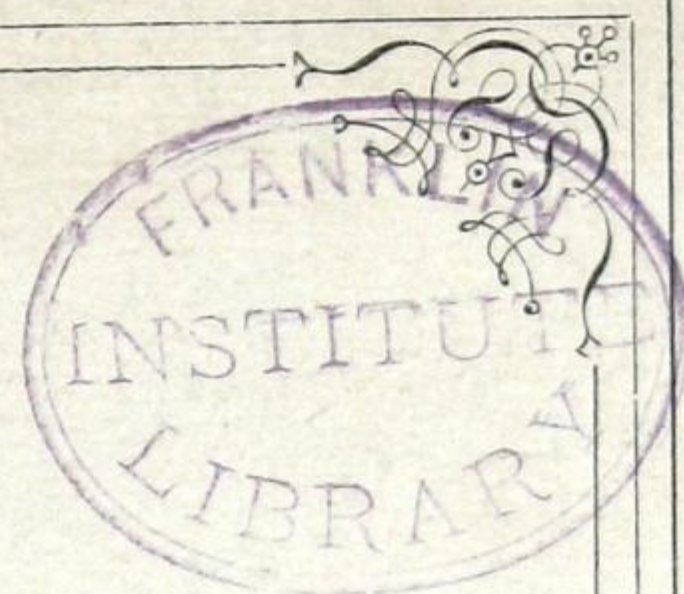
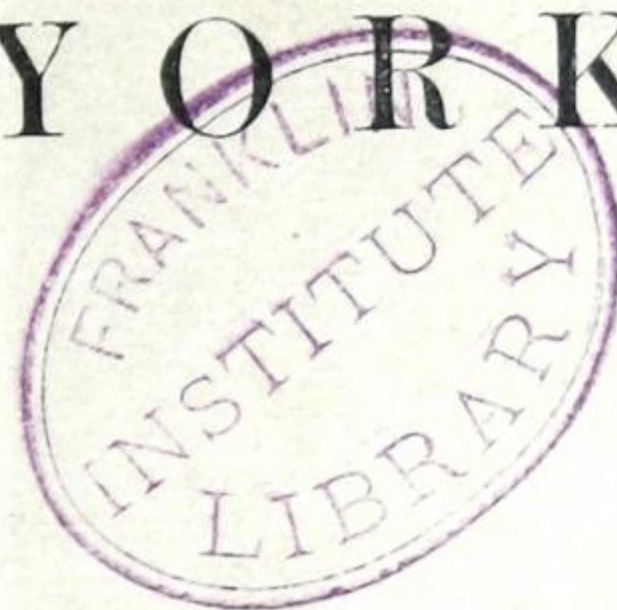


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NEW YORK



OXYGEN GAS COMPANY

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NEW YORK

OXYGEN GAS COMPANY.

Process of Tessié du Môtay and Maréchal, France.

Works, No. 547 West 41st Street, near 11th Avenue.

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NEW YORK

OXYGEN GAS COMPANY.

This Company is organized under the laws of the State of New York, for the manufacture of Oxygen Gas, according to the process of Tèssie du Môtay and Maréchal, of France. Having been in operation several months, the Company is prepared to give satisfactory evidence of the economical production of the gas. The results of this process, as established at the works in Paris and New York, show complete success.

The importance of oxygen gas is well understood by scientific men ; and its cheap production has been sought for, as a boon to humanity. Probably no element in nature is more important to mankind ; and when practically applied in the various departments of industry—according to the testimony of leading savans—will create a revolution in industry, and a progress in civilization equal to, if not beyond that produced by any modern discovery. Oxygen is the “vital air.” Prof. J. C. Draper, M. D., in an article in the *Galaxy* for December, 1869, says : “From the moment of its birth, an animal commences by some species of respiratory process to separate oxygen from the air and appropriate it to the wants of its system. Sleeping or awake, in motion or at rest, the inexorable demand for the gas must be met.”

Of the eight or nine pounds of sustenance required to supply the daily wants of the body, $2\frac{1}{2}$ pounds consist of oxygen derived from the atmosphere. Medical men are impressed with its importance as a remedial agent in many forms of disease, and are extending its use in their practice, with success. Dr. O. Tamin Despalles, of the

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Paris Faculty, among other important statements, says: "The daily use of directly breathing it (for a few minutes) constitutes a powerful hygienic resource, without any inconvenience; useful in all diseases, applicable to all constitutions, and now accessible to all classes. I doubt not that it is to the lungs what water is to the skin; cleansing them of their impurity, the presence of which alters the regular course of their functions."

It is believed that its free introduction in hospitals and sick rooms will neutralize the malaria of contagious diseases and epidemics. Its cheap production will bring it within the reach of extended medical experiments, and thus yield its beneficent power to overcome the "ills which flesh is heir to," and revivify the depressed energies of the invalid.

As a source of light and heat, its powers are well known to be invaluable.

In recognition of the importance of this discovery, the Emperor Napoleon has bestowed upon Tèssie du Môtay, (the inventor,) the Cross of the Legion of Honor, and other tokens of favor. He has ordered the Tuilleries to be lighted with oxygen as soon as the work of laying the mains is completed.

This Company has the sole right to manufacture oxygen gas in the City of New York, under the patent, for all purposes, and proposes to extend its operations, so that ultimately it may be introduced into every street and building, bringing with it light, heat and health, according to its uses.

Its economy as a light has been well ascertained, and it would seem that there is no enterprise now existing in which public benefit and private advantage can be more completely developed.

This Company is now supplying oxygen gas to physicians, colleges, theatres, and that used for Drummond or calcium lights in processions and public places; also for the night work at the grounds of the new Post-Office, in the Park. It is receiving orders for it from different parts of the country, and for various uses.

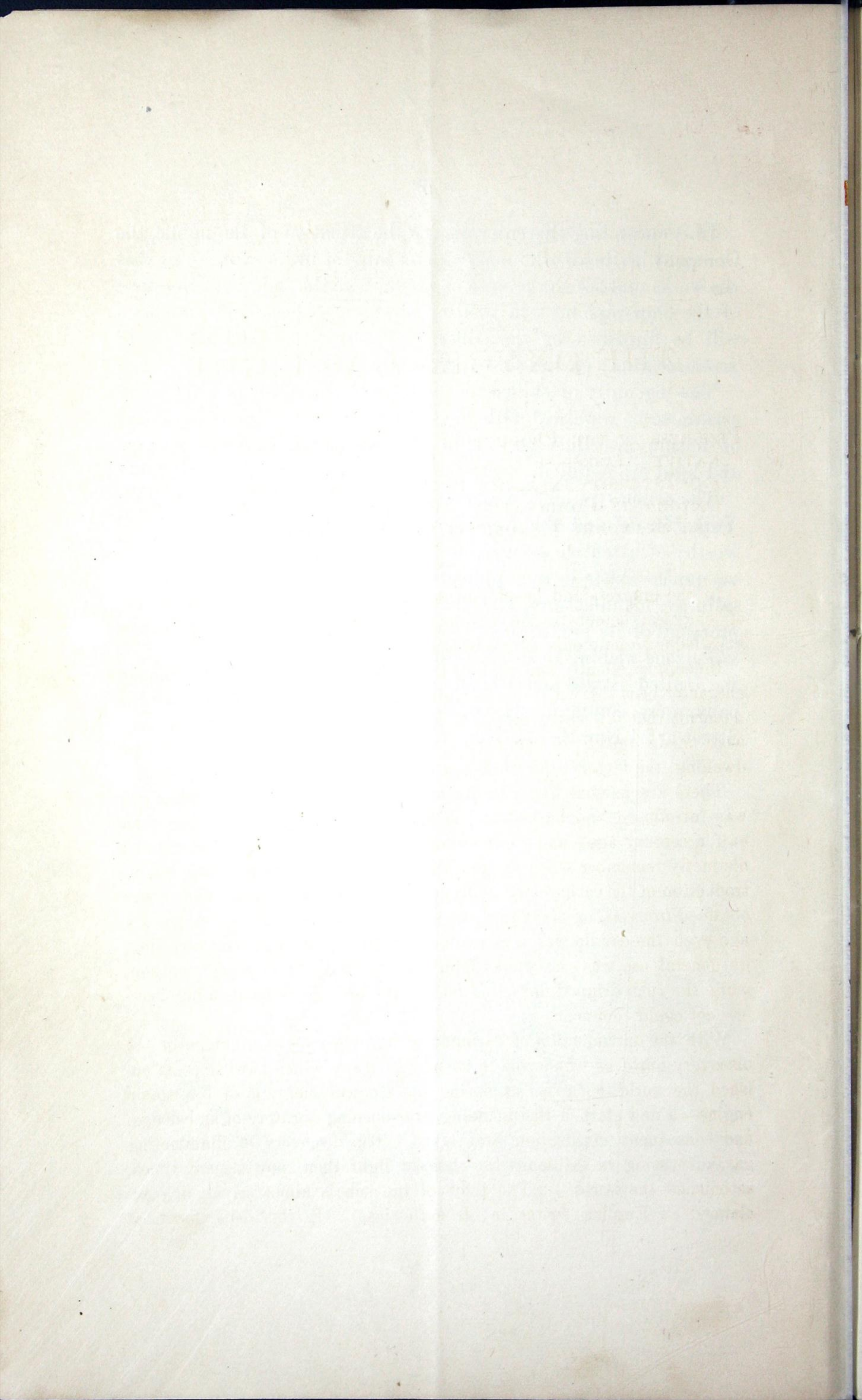
About \$6,000,000 per annum is paid to four gas companies in New York; and capital invested in such companies throughout the country has, with good management, uniformly received large dividends.

In commending this enterprise to the attention of the public, the Company invite all who may take an interest in its progress to visit the works and see the process of production, the light, and the effect of the blow-pipe heat in melting steel, etc. Tickets of admission will be furnished by the Officers and Trustees. The gas will be given to proper parties for experimental purposes.

The ingenuity of skilled mechanics and the talent of inventors is certain to be rewarded with success, as they press this great power of nature into their service, in the various industries where heat and light are required.

The articles published herewith appeared originally in the *New York Herald* and the *Engineering and Mining Journal*, and are worthy of attentive perusal, as they show what a vast field for development exists in the applications of oxygen to illumination, metallurgy, manufactures, and the arts and sciences, and describe the processes of its production.

Persons wishing to secure rights under the patent, in any part of the United States and Canada, or to invest capital in this Company, may communicate with H. M. BENEDICT, 547 West 41st Street or 24 New Street, New York.



THE OXYGEN GAS LIGHT.

PROGRESS IN THE PRODUCTION OF ARTIFICIAL LIGHT — ILLUMINATIVE GASES — PRIVATE EXPERIMENTS ON THE DENSITY AND INTENSITY IN LIGHT BETWEEN CARBURETTED HYDROGEN, OXYGEN IN COMBINATION WITH STREET GAS AND THE ENGLISH STANDARD CANDLE ON THE PHOTOMETER.

In the progress and development of science there has been no branch of chemical demonstration which has marked the advance of human knowledge so pointedly as the production of artificial light.

Indeed, so silently and rapidly have discoveries of the most profound character been thrown upon the world, and made necessities almost on the moment, that few have stopped to inquire by whom, when or where they were made objects of commerce, or conveniences indispensable to the dwelling, the factory, the workshop and the street.

There are persons living in this city who have not forgotten when gas was introduced and burned in the house No. 7 Cherry street, less than half a century ago; and there are many living in London and Paris who distinctly remember when the brightest artificial light—preceding the introduction of the carburetted hydrogen or common street gas—known was obtained from oil, or the tallow, the sperm or the wax candle. A century ago even the candle was a miserable apology for sunlight, and preceding its general use was the smoky flambeau, the torch in city and mansion, while the rush dripped in melted fat was the best the peasant in his cheerless cot could command.

With the introduction of carburetted hydrogen as an illuminator—a discovery quite as wonderful in its way as many which have since astonished the world, not even excepting the electric telegraph or the steam engine—a new start in the unending, ever-opening highway of knowledge, and consequent civilization, was taken. The discovery of illuminating gas, surpassing in brilliancy the choicest light then known, many times, astonished the world. “The light of the sun is almost rivalled,” exclaimed an English writer, in his enthusiasm. In this department, at

least, science can no further go. Chemistry has reached its *ultima thule*. It has bestowed an inestimable boon upon mankind, and for this it should be revered. It has given light; it has turned night into day.

The body of the people were doubtless pleased with the introduction of the carburetted hydrogen gas into their streets, dwellings and stores; but those curious persons who are forever questioning, torturing and coaxing nature out of her secrets, were not. They demanded from her something more. They desired a light brilliant as that of day, if it were possible.

Many brave attempts, it must be confessed, have been made to put the great central illuminator of our system out of countenance; but although much has been done toward solving the problem as to whether the sun, or chemistry combining and burning certain of its gases, can produce the most light, thus far old Sol yields the cheapest, the most desirable and the brightest. The calcium or lime light was a grand discovery, but it could not be safely, generally and cheaply used. Next to it, but many, many times more brilliant, is the electric light—a light which almost seems to be illuminative as the sun. The electric light is, however, uncertain; it blinks and winks, and at inopportune moments puts itself out, and is very costly. Next to these, and, perhaps, more agreeable, as it certainly is cheaper than every other kind now in use, is the oxygen light.

This light, the intensity of which was measured on Tuesday evening in the photometric department of the College of the City of New York, by Professor Doremus, is the invention of French savants, and must of necessity, from its purity, brilliancy, agreeableness and cheapness, almost immediately supplant every other form of gas light, whether made from oil, coal, tar, or any substance known in which carbon preponderates. In the course of the Professor's experiments, it was shown that, while the intensity of a jet of carburetted hydrogen gas manufactured by the Manhattan Company was only, as tested by an oiled disc placed on the photometer, thirteen and a half times greater than was the illuminative properties of the English standard candle, by which all light is measured, the oxygen light, consuming about one-third the number of cubic feet in the hour, was more than six times stronger; or, to make the matter plainer, while a jet of common gas possessed an illuminative property thirteen and a half times that of the candle, the jet of oxygen and carburetted hydrogen gases, compared with the carburetted hydrogen and air, was approximately as nineteen to one, and with the English standard candle as two hundred and fifty-six times to one. In other words, to equal a jet of oxygen with coal gas, in its light-giving property, two hundred and fifty-six candles of the English standard would have to be burned, or, in their

place, thirteen jets of street gas, consuming each five cubic feet to the jet, for oxygen gas burning two cubic feet within the hour.

This is wonderful; and had we not been present and closely followed the Professor while conducting his experiments, it is a question if we could readily accept the final statement.

This is not all. The commercial value must be taken into consideration. It is of little use to offer a beautiful and brilliant light if it is not in consonance with our ideas of economy. If the oxygen gas, with nineteen times the intensity of the carburetted hydrogen, were proportionately expensive, (the street gas costing \$3.50 per one thousand cubic feet,) it could never be brought into common use; but as it can be obtained at a comparatively moderate figure—actually at a lower rate than the carburetted hydrogen, with which in equal parts it is made to combine—the question of general use need not be taken into consideration; it must follow of necessity. We may approach the cost of the gases in this wise:

If by burning one-third the amount of street gas we produce six times the quantity of light for the same number of cubic feet of street gas, consumed with pure oxygen, we should have eighteen times the quantity of light. To produce the same amount of light, we would require only one-eighteenth the quantity of street gas. Instead, therefore, of purchasing \$3.50 worth, or one thousand cubic feet of street gas, we need only one-eighteenth, or about twenty cents' worth, or fifty-six cubic feet, for the same light. This coal gas needs an equal volume of pure oxygen for its complete combustion, hence we must have one-eighteenth of one thousand cubic feet. Suppose oxygen should be sold at \$20 per one thousand cubic feet, we would only require \$1.11 worth, or one-eighteenth of \$20 to consume the coal gas. Hence to have light equal to \$3.50 worth of coal gas as ordinarily burned, we would only want twenty cents' worth of coal gas and \$1.11 worth of pure oxygen, or \$1.31 worth of the two gases. If, however, the light should be only ten times as brilliant, we would then require one-tenth the quantity of coal gas, or thirty-five cents' worth, and of pure oxygen one-tenth of a thousand, or one hundred cubic feet. This, at \$20 a thousand, would be \$2; hence, cost of street gas, thirty-five cents—cost of pure oxygen \$2; total cost \$2.35, for a light equal to \$3.50 of coal gas as ordinarily consumed, with all the other advantages of purity of color, steadiness, diminution of heat and of impurities. The French experiments give an increase in illuminating power of sixteen and a half times that of a standard burner. The ordinary ground-glass shade reduces the light one-half in brilliancy, though it makes it more voluminous.

It is curious to trace the progress which has been made in developing

artificial light within the last two hundred years. First, in the country places of Europe we had the rush, stripped of its outer coating and dipped in melted fat, giving, when ignited, a feeble and uncertain ray; next, in the towns, the torch and the link charged with resin; then the wick floating in oil, followed by the candle, first of tallow or other adipose substance, subsequently improved by the introduction of sperm and wax. Contemporaneous with the candle, we had the first vegetable and afterwards the animal oils; then camphenes and phosgenes of various strengths. Anterior to these last was the carburetted hydrogen or common street gas. Mineral or rock oils have taken the place of the animal or vegetable oils within the past few years—even measurably displacing the street gas. And now all these must give way to the greatest and grandest discovery of all—the method by which oxygen can be obtained and consumed in association with carburetted hydrogen—say at three-fifths less cost, while it offers a light fully nineteen times more powerful than the gas furnished by the Manhattan Company, which, however, as the experiments of Tuesday proved, was much below the legal standard.

That the oxygen gas will speedily be brought into general use in this city as an illuminator, we have reason to believe. The manufacture, or rather its extraction, will be found far from costly, as the manganates from which it is extracted neither burn nor wear out. They are simply resolved by the action of steam, which is passed over them, extracting the oxygen, and then by heat are restored to their original condition, when they again become charged with the peculiar element—for which they have a strong affinity—taken from the atmosphere.

Several of our most enterprising and intelligent capitalists have organized themselves into a company, and are about to commence the erection of suitable works, where the oxygen can be obtained for general use. The gas is portable; it can be conveyed to theatres, hotels, public buildings, workshops and mansions at trifling cost, and burned in combination with the street gas, thus reducing the consumption of the former more than one half. In time it will be conducted, as street gas now is, through the city by mains, and thence to each lamp-post in the city, making with its rich white light everything clear and beautiful that comes within its rays.

Another matter which should not be forgotten in connection with this light. Its introduction will greatly add to the purity of the air in public halls, theatres and mansions; for it supplies its own oxygen, instead of robbing the air, and yields only a sixteenth or eighteenth part of carbonic acid.

Looked at from every side, the new light commends itself to the public. It is cheaper, healthier, cooler, more brilliant, softer and whiter than common gas. With ladies it will certainly become a favorite, as, unlike gas, it does not try the complexion. Under its rays the eye can readily detect shades of color, selecting the various grades of blue from those of green—a thing next to impossible under the common carburetted light.

Our streets, supplied with the oxygen gas, would at night exceed anything in the way of public illumination that has ever been attempted. Imagine a square lighted from nineteen gas lamps where one now flames, and some idea may be formed of its value. In the prevention of burglaries and other high crimes ordinarily attempted at night, it would in the course of a year save at least half its cost, while no part of the city would be so dark, even on the blackest nights, as to prevent the perusal of the features of any one within the distance of twenty feet.

It thus has everything to recommend it. For the dwelling, and where people congregate in large numbers, it will not only give a splendid light, but assist in adding to the purity of the air momentarily breathed; while in the public ways it is certain to give the police a better view of the avenues they patrol, and thus prevent even the most desperate housebreaker from running the hazard of detection.

REPORT BY PROFESSOR DOREMUS.

The annexed report, detailing Professor Doremus' investigations into the properties of the new light, and the many important uses to which the super-abundance of oxygen (now that it can be readily and cheaply obtained) can be applied, made to Messrs. Stern, Stevens and French, in connection with "the processes of Messrs. Tessié du Môtay and Maréchal, of France, for producing oxygen and hydrogen gases, will be read by all who are interested in the developments and discoveries of science as applied to the necessities and luxuries of life:

GENTLEMEN: The isolation of oxygen gas ranks first in importance among chemical discoveries.

This element forms more than one-half the weight of the known parts of the globe, including the crust, the water and the atmosphere, and the vegetable and the animal kingdoms, demonstrating the functions it has performed from the earliest epochs of our earth's history to the present time.

The affinities of this element surpass those of all others. It is universal in its appetencies. But one substance exists with which it has not been demonstrated that it will combine.

The revelation of its marvellous properties overturned the doctrines of chemistry, and this science dates its rise from the year 1774, when Priestley, in England, first liberated oxygen from the red precipitate, or red oxide of mercury, by concentrating upon it the heat from the sun.

Almost instantaneously, Lavoisier, of France, and Scheele, of Sweden, made the same discovery, each ignorant of the other's triumph.

To the chemical affinities of oxygen we are indebted for the artificial production of power, and the imponderable forces—light, heat, galvanism and electro-magnetism.

With the exception of wind and water power, it is the source of all motion under man's control. Our intellectual and physical forces, as well as brute power, are pre-eminently due to the respiration of atmospheric oxygen.

The tortoise breathes but little of it, and crawls on the earth; the bird much, and flies in the air.

All machinery moved by steam—whether used in factories, in vessels for freight, or travel by land or by water—depend upon the union of oxygen with fuel.

The basis of improvements in speed attained by the locomotive, or of power in steam engines, is increased in the supply of oxygen.

Electricity as applied to telegraphic or motor purposes, depends on the oxidation of zinc in the galvanic or voltaic battery.

We estimate the comparative expense of steam and electricity by counting the cost of carbon *versus* zinc, both of which elements must be associated with oxygen.

It is the sudden release of oxygen in gunpowder, gun-cotton, that fulminates, or in nitro-glycerine that propels the projectile or blasts the rock.

Excluding the warmth derived from the sun and stars, with trivial exceptions, we can trace all heat to the affinities of oxygen as its source.

The lengthened chimneys to our furnaces, the blowers for hot or cold blasts, increase the fervency of the heat by increasing the supply of oxygen.

Upon this "vital air," as it was once called, our own peripatetic furnaces chiefly depend for heat, by the combustion of our food and of the tissues of our bodies.

The varying warmth of different forms of animal and insect life, is graded by the amount of oxygen inspired.

As a general rule, all light produced upon the earth, from the pale

phosphorescence of the humble forms of aquatic life, or that of the glow-worm or fire fly, to the most brilliant devices designed by man, emanate from the combinations of oxygen.

The candle, the oil lamp and coal gas, in order to evolve light, need oxygen "to support their combustion."

The much more brilliant Drummond light is produced by burning hydrogen, or carburetted hydrogen, with pure oxygen, and in contact with lime, magnesia or other solid, which, for the time, is rendered incandescent.

Metallic magnesium burns with dazzling brightness, because of its affinity for oxygen; and the most effulgent of all lights ever made by science and art combined, comparable even with the sunbeam—the electric light—originates from the reactions of oxygen in the galvanic cell.

This condensed statement of the services performed by oxygen in the progress of science, is made to demonstrate the importance of producing this element abundantly, and at a commercial price.

Ever since its discovery, chemists, appreciating the vast and varied benefits derived from it, have sought to insulate it from its associates by methods simple and yet capable of furnishing it in quantity and at reasonable rates; but all have as yet failed.

To procure it from the chlorate of potassa, the source ordinarily resorted to, is so expensive that pure oxygen gas is a luxury, and, until within a few years, only employed to illustrate scientific lectures. It is now used to a limited extent where intense heat is demanded, as in the fusion of platina, or to produce the "Drummond," or, as it is sometimes erroneously called, the "calcium light," for illuminating theatrical scenes and outdoor gatherings for political or other purposes; but to resort to it as a source of light or heat for general uses has been impossible, as its preparation costs between from \$150 to \$200 a thousand cubic feet.

The discovery of a cheap and speedy method of obtaining oxygen will rank as one of the most brilliant revelations of the age, and will confer invaluable benefits upon the civilized world.

I have followed with great interest the claim of Messrs. Tessié du Mô-tay and Maréchal, of France, ever since their first announcement of having accomplished this long-desired result. I have studied carefully the patents, reports and other documents you have put in my possession, and have had frequent interviews on this subject with your accomplished chemist, M. Schwarzweber, who has been practically familiar with this process since its inception, and has performed the experiments, in behalf of the inventors, before the commission appointed to make photometric investigations in Paris.

This process depends on the following facts : That oxygen gas not only exists in the atmosphere, but that it is not chemically combined with its associated gases, and is, therefore, easily extracted by certain chemicals when they are heated in its presence; that they in turn, on being heated with steam, yield up this oxygen, which can be collected and conserved in suitable reservoirs.

The manganates and permanganates of potash, soda or baryta; the chromates, ferrates, and in general all metallic oxides or acids forming with potash, soda or baryta, binary combinations capable of being super-oxidized, possess this property of yielding up a portion of their oxygen when heated in the presence of the vapor of water. Salts thus deoxidized will re-absorb oxygen when exposed to a current of air freed from moisture. By passing steam over layers of manganates of soda, Mn O_3 , Na O , (the compound usually employed,) heated in suitable retorts, water combines with the soda and forms hydrate of soda, and the liberated manganic acid parts with a portion of its oxygen, and is reduced to a lower oxide. To express it by symbols: $2 (\text{Mn O}_2 \text{ Na O})$ plus $2 (\text{HO})$ are equal to $2 (\text{Na O, HO})$ plus $\text{Mn}_2 \text{O}_3$, plus O_3 . From this lower state of oxidation, the hot oxide of manganese is again converted into manganic acid. By passing air over this heated mass, the sesquioxide of manganese seizes the oxygen from the atmosphere, is converted into manganic acid, reasserts its sway over the soda, decomposing the hydrate, forming once more the manganate of soda, and expelling the vapor of water. Steam is again passed over and through the porous manganate, causing the discharge of oxygen, followed by the refreshing and reinvigorating air. These operations are alternated each half hour. As the vapor of water is discharged from the retorts it passes into condensers, while the pure oxygen is conveyed to the gas holders. Though the amount of carbonic acid gas in the atmosphere is trivial in comparison with the nitrogen and oxygen gases, it is found desirable to remove it, lest it form the carbonate of soda. This is accomplished by forcing the air through a cylinder containing caustic soda, which not only combines with the carbonic acid but also abstracts the moisture. An important discovery has also been made--that the alternate exposure of these chemical compounds to the action of dry air and steam, can be incessantly repeated for months without causing any palpable loss in this absorbing and discharging power. The alkaline manganates are produced by passing a current of air over a mixture of the hydrates of potash or soda, and the sesquioxide and peroxide of manganese raised to a suitable temperature. Therefore the salt employed is not expensive; moreover, the oxide of manganese can be procured here as cheap, if not cheaper, than in Europe.

The retorts and machinery required for the operation are neither bulky nor costly, and the temperature at which these chemical changes ensue is a dull, red heat, about 850 degrees Fahrenheit, though, by the last accounts from Paris, it is now accomplished at from 500 to 600 degrees. Hence the apparatus employed is not liable to rapid destruction.

For these reasons, I believe that the long-desired discovery has been accomplished by Messrs. Tessié du Môtay and Maréchal, that of producing pure oxygen at a price which will enable us to employ it for heating and illuminating purposes.

I venture to predict that this discovery will work an entire revolution in our system of lighting streets and public and private buildings. For brilliancy, economy and health combined, the light produced by it surpasses all others with which I am acquainted.

I have frequently witnessed this light as exhibited at your office. I have also examined the reports of the photometric experiments made at the laboratory and in the presence of M. Le Blanc, engineer-in-chief of the office of registration for lighting the city of Paris, and before Commandant Caron, director of the laboratory of the Museum of Artillery, by your chemist, M. Schwarzweber, at the request of the Emperor and the Prefect of the Seine.

It possesses the following advantages:

First—It is more purely white than most of the lights ordinarily used; hence must be a blending of the various colors in quantity and proportion, more nearly approaching the sunbeam. All the more delicate shades of whatever hue are seen almost as though illuminated by daylight. It is well known that this cannot be said of coal gas, as ordinarily employed, for paintings, decorations, colored dresses, ribbons, gloves, &c., present certain tints by natural light and others by the usual artificial lights.

Second—It is many times more brilliant than the standard gaslight, with the same consumption of coal gas. According to the French reports, it excels by sixteen and a half times that produced in the city of Paris. I find it to exceed ours (that of the Manhattan Gas Company) consumed in the English standard Argand burner, with fifteen holes, and with glass chimney seven inches in height, to the same, and at times to a greater extent. When this light is caused to pass through the hot ascending current of gases from any ordinary flame, the refraction of the light can be seen on a white surface, literally causing these lights to produce their own shadows.

Third—The light is steady and without flicker. Our “bat-wing” and

“fish tail” burners yield wavy, tremulous flames, very trying to the eyes, and especially annoying and injurious to those who are obliged to employ artificial light for many consecutive hours. Even the highly-esteemed Argand cylinder of light loses character when placed beside it. This must be so of necessity, for they are flames, and therefore agitated by the constant currents of air which they themselves excite, and which may be produced by other causes, while this light (the oxygen gas) emanates from a solid pencil of compressed magnesia, fixed in a solid support, and rendered incandescent by jets of carburetted hydrogen (or hydrogen) burning with pure oxygen. Not only will physicians understand the value of these qualities in relation to diseases of the eye, too often produced by the employment of poor and unsteady light, but all readers, students, artisans and others who are obliged to work in many places even in the day by artificial light, as well as those whose labors at night require such assistance, will keenly appreciate the blessing conferred in this form of illumination.

Fourth—Much less heat is thrown out by this light than from any of the gas or petroleum flames, although it excels them all in brilliancy; and the discrepancy is still greater if the comparison is made with lights of equal illuminating power. The uncovered hand cannot be held over the ordinary Argand burner, yet it may be placed over this light with impunity, though it so far exceeds it in brightness. The explanation of this apparent paradox is simple: Coal gas, when mixed with air, as in the various forms of “Bunsen’s burners,” so well known in chemical laboratories, and used in “gas stoves,” may be consumed without producing light, except of a pale blue color, too feeble to enable one to see with. Thus, the whole effect of the combustion is to generate heat, which is the object aimed at, while the same coal gas, not mingled with air until burned, will furnish light as well as heat. Hence we may have the same amount of chemical action at one time resulting in heat alone, and under other conditions evolving luminous as well as calorific rays—furnishing a beautiful illustration of the correlation of forces. When oxygen and pure hydrogen unite, they produce a most intense heat, over 14,000 deg. Fahrenheit, and ranking next to the galvanic current—yet the flame is almost invisible by daylight. If, however, any solid body be held in it, even though non-combustible, as lime, magnesia, &c., the imponderable force heat is transmuted into light.

By this mode of illumination, therefore, one of the objectionable features in the use of coal gas, viz.: the oppressive heat, both in private

residences, in churches, theatres, (especially in the summer season,) is in great part removed by this invention.

Fifth—This light does not vitiate the air as much as other lights of equal brilliancy—a sanitary consideration too often neglected. Ordinary artificial lights injure the atmosphere in two ways—by removing its oxygen, which is so essential for respiration, and by producing carbonic acid gas. A single six feet burner will yield as much of this poisonous gas as eight or nine persons would expire in quietude, while it would abstract more oxygen from the surrounding air than they would absorb in the same time.

In this new lamp oxygen is supplied in sufficient quantity to consume the coal gas, the atmosphere is not taxed to aid the combustion, and as the consumption of carburetted hydrogen in this burner is from one-sixteenth to one-twentieth for the same illuminating power, there will be proportionately less of impurities resulting from its use.

From our gas flames a portion of unconsumed carbon always arises, which darkens the ceilings, soils the walls and the furniture. No such smoke escapes from this light, for the combustion is complete.

For out-of-door illumination it has an additional advantage, that by no possibility can it be “blown out.” The chemical action is so intense that it cannot be extinguished in the stormiest weather; and even if the two gases be shut off for a minute or two, the glowing pencil of magnesia will relight them when they are again turned on. The preparation of this oxygen differs markedly from the making of coal gas. There is no ill odor attending it; and if hydrogen should be employed, as proposed by the same ingenious French chemists, their method of fabricating it by heating fine anthracite coal dust, peat or other carbonaceous substance mingled with hydrate of lime, would furnish us with means for illuminating and heating, without contaminating the atmosphere of our crowded cities with the nauseating and unwholesome gases with which we are now annoyed.

In point of economy by the use of oxygen and carburetted hydrogen combined, with the same amount of light the public may save from thirty to forty per cent. in money, allowing large profits to the manufacturers; or for the same price may have many times more brilliant, perfect and wholesome light than is offered them at present.

In the Drummond light, the piece of lime usually employed crumbles in a few hours. These pencils of compressed magnesia last a week; and by recent improvements in Paris, crayons have been patented which have

thus far been proved to be indestructible, as "they have been employed for thirty consecutive days without any alteration, being like new."

This style of lamp requires a duplicate tube—one for the oxygen, and the other for the common illuminating or pure hydrogen gas. Prior to the employment of this most bulky illuminating agent, we can readily imagine the stout arguments wielded to demonstrate how dangerous and impracticable, to say nothing of the expense, to lay metallic pipes for conveying a combustible agent through every street in a great city—aye, and in every house and into every room of every public or private residence. If the advantages to be procured by this method are as above warranted, how weak the argument against an additional pipe for conveying this pure and wholesome gas.

It has long been a favorite belief with many that the time would come when gases might be commonly employed for heating as well as for illuminating purposes.

In our chemical laboratories it is constantly employed, and to some extent gas stoves and fireplaces, from their great convenience, are resorted to. This reduction of the cost of procuring heat-yielding gases, renders the idea less problematical, and I confidently believe it is within the power of these new processes to at least enable us to perform all culinary operations by their aid alone.

At present, almost every kitchen in our city has from half a bushel to a bushel or more of coal burning from morning till night for those purposes, partly because of the trouble and expense of relighting the fires. By this method, the striking of a match and turning of a stop-cock would be all the labor requisite to ignite the fires for preparing our meals and heating our dwellings.

For furnaces and factories where the oxygen would be prepared on the spot, I learn that it can be generated at a cost of from \$2 to \$3 a thousand cubic feet! Any chemist can foresee what a revolution this is destined to produce in metallurgic and other operations where this agent is demanded.

Its relation to iron and steel involves millions of dollars. So speedily has this been appreciated abroad, that the large steel works in Bradford, England, have already made arrangements for the immediate adoption of this process.

I learn also that the proprietors of one of the largest iron works in France are negotiating for its use, and that furnaces are being erected for generating oxygen by this system, to be employed in one of the French glass factories at Lyons. In lieu of long chimneys and blasts of diluted oxygen, that pure oxygen is to be used for blowing fires.

For the economical production of hydrogen gas, to be used as a substitute for coal gas, these chemists employ the hydrates of potash, soda, strontia, baryta, lime, &c., intimately mixed with charcoal, coke, anthracite or peat, and raise them to a red heat in retorts.

The reaction between hydrate of lime and fine anthracite coal would be, that the water of the hydrate would be deoxidized by the carbon, forming carbonic acid, and hydrogen gas would be liberated: $2 (\text{Ca O, HO}) \times \text{C} = \text{Ca O} \times \text{CO}_2 \times \text{H}_2$.

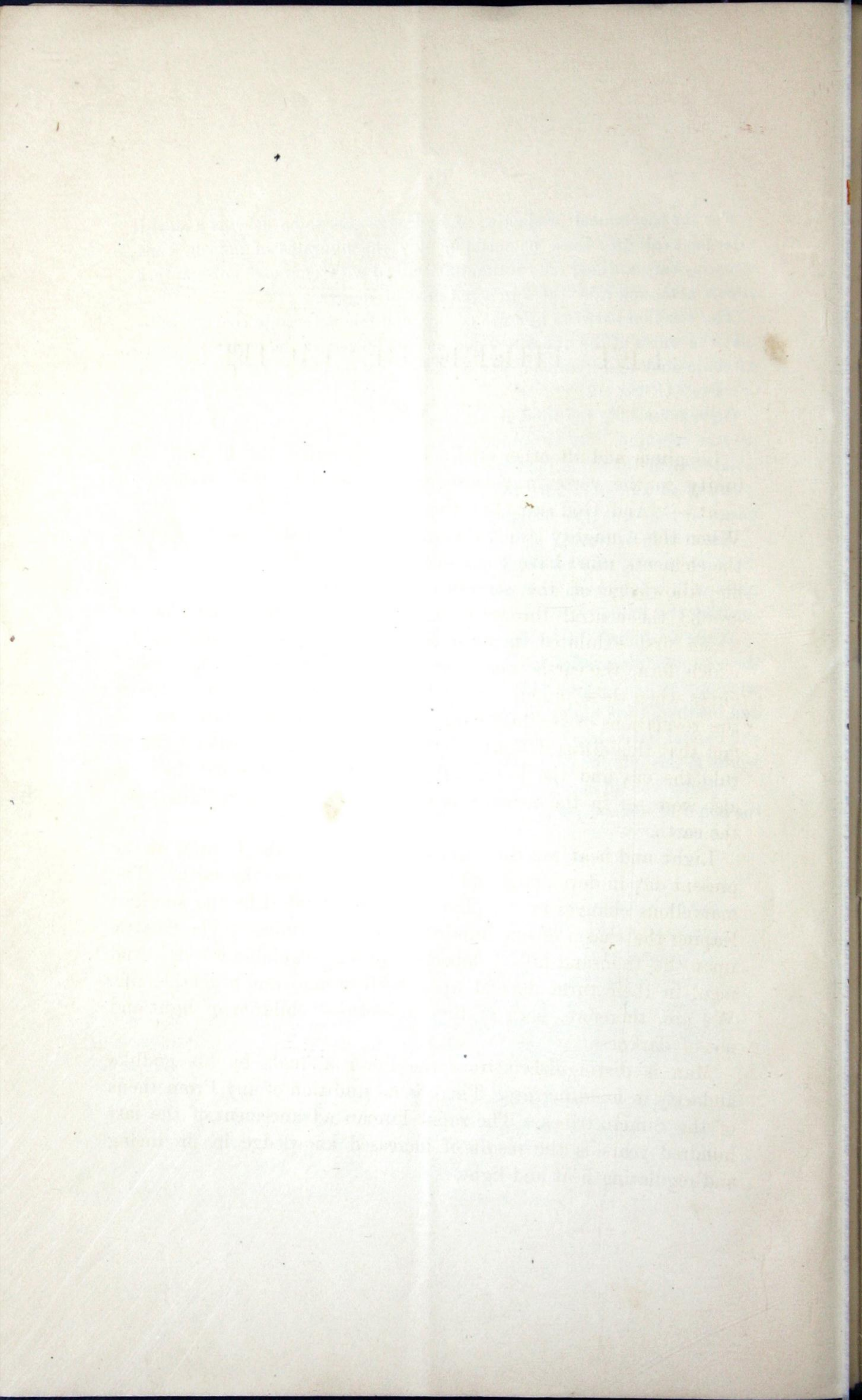
On remoistening the lime, it again becomes a hydrate, and the process may be repeated. By absorbing the carbonic acid, hydrogen may thus be isolated with the same facility and at a much lower price than coal gas, with the advantage alluded to of avoiding the generation of the ill-odored gases, at the same time utilizing the coal dust refuse.

The loss in delivering said gas through lengthened tubes, owing to its diffusive power, may be overcome by simply coating the interior of said pipes with some cheap and impervious lining, at the same time carefully securing the joints.

While I admire the courage you exhibit in undertaking to introduce these capital discoveries in this country, where they will no doubt meet with opposition because they aim to revolutionize our system of lighting and heating, I am happy to congratulate you that gentlemen of influence and capital have already associated themselves for the purpose of erecting works in this city for producing oxygen gas for industrial applications.

Wishing you all success as promoters of scientific advancement, I have the honor to remain, yours respectfully,

R. OGDEN DOREMUS.



LET THERE BE LIGHT!

Longinus and all other critics have attributed the highest sublimity to the verse in Genesis which describes the creation of light:—"And God said, Let there be light, and there was light." When the Almighty issued this mandate chemistry teaches us that the elements must have commenced their combinations, and from our knowledge of the structure of one of the planets floating around the central throne, oxygen must have been the element which first exhibited its affinities. The various metallic oxides which form the earth must have evolved light and its associated forces when these unions occurred. The essential harmony between the revelations of Scripture and science is finely illustrated by the fact that this diffused light existed even before the greater light to rule the day and the lesser light to rule the night, and the stars also were set in the firmament of the heavens to give light upon the earth.

Light and heat are the means employed by the Creator at the present day in developing and sustaining life upon the earth. The marvellous changes in the planet are accomplished by the sunlight leaping the chasm of one hundred millions of miles. The "cattle upon the thousand hills" depend upon the vegetable world. And men, in their turn, depend upon both animal and vegetable life. We are, therefore, born of the sunbeam—"children of light and not of darkness."

Man is distinguished from the lower animals by his godlike audacity in handling fire. There is no tradition of any Prometheus of the Simian tribes. The rapid human advancement of the last hundred years is the result of increased knowledge in producing and regulating heat and light.

The very latest discovery in this direction is due to certain French chemists, of whose processes for accomplishing the long desired result of producing pure oxygen abundantly and at a price which will enable us to employ it for heating and illuminating purposes, we publish to-day a full and interesting report by Professor Doremus. Dr. Doremus shows how we are indebted to the chemical affinities of oxygen for the artificial production of power and the imponderable forces of heat, light, galvanism and electromagnetism. He indicates the manifold uses of oxygen in union with fuel, applied to machinery in factories, vessels for freight or travel, to gunpowder, gun cotton, the fulminates, nitro-glycerine, in furnaces, laboratories and all culinary operations. He sets forth the facts on which the processes for obtaining the new light depend, and gives his reasons for endorsing the claims of Messrs. Tessié du Môtay and Maréchal to this important discovery, which he pronounces to be one of the most brilliant revelations of the age. He predicts that it will work an entire revolution in our system of lighting streets as well as public and private buildings, and that, in a great variety of ways, it will prove an inestimable benefit to the civilized world.

Dr. Doremus enumerates the peculiar advantages of the new light. By repeating himself the photometric experiments made at Paris, he finds that it is many times more brilliant than the standard gaslight with the consumption of coal gas. According to the French reports it exceeds sixteen and a half times that produced in Paris, and it exceeds to the same and sometimes to a still greater extent the light of our Manhattan Gas Company, consumed in the English standard argand burner, with fifteen holes and with a glass chimney seven inches in height. For brilliancy, and also economy and health, this new light surpasses all other lights usually employed. More purely white than any of the latter, its blending of the various colors in quantity and proportion more nearly approaches the sunbeam. It reveals all the more delicate shades of every hue almost as if they were illuminated by daylight. It is steady and unflickering, and thus guarantees against the frequent diseases of the eye, to which students, printers and the artisans of many trades obliged to work at night or in the daytime by artificial light are

liable. Flames must flicker, but this light emanates steadily from a solid pencil of compressed magnesia or zircon fixed in a solid support and rendered incandescent by jets of carburetted hydrogen (or hydrogen), burning with pure oxygen. It is admirably adapted for out-door illuminations, not only by its intense brilliancy, but also because it cannot be blown out in the stormiest weather. It throws out much less heat than any of the gas or petroleum flames, although it excels them all in brilliancy. Thus it will enable us to get rid of the oppressive heat which in summer renders churches, theatres, and concert rooms so uncomfortable and unhealthy. No such smoke as usually darkens the ceilings and walls, injuring pictures, books and furniture, escapes from this new light. It does not vitiate but on the contrary tends to purify the air. Even the making of this oxygen is attended by no ill odor, and by its universal substitution for our present gaslight we should be freed from the nauseating and unwholesome gases that have made the gas houses in Paris, London and New York such intolerable nuisances. The economy of the use of oxygen and carburetted hydrogen combined is clearly exhibited by Dr. Doremus. With the same amount of light the public may save by it from thirty to forty per cent in money, allowing large profits to the manufacturers; or for the same price they may enjoy a light more brilliant, perfect and wholesome than any which is offered at present.

The English, whom Mr. Mill lately alarmed by predicting the approaching exhaustion of their coal fields, and the threatened consequent loss of their supremacy as a manufacturing nation, may now be reassured by the prospect of an efficient substitute for coal as a source of light and heat. In fine, the whole civilized world may rejoice in man's latest scientific applications of oxygen, the element which first exhibited its affinities at the dawn of creation, when God said, "Let there be light!"

New York Herald.



THE OXYGEN GAS WORKS OF NEW YORK.

BY DR. ADOLPH OTT.

It may seem strange at first sight that many of those substances existing in the largest quantities are coupled with the greatest obstacles to their economic utilization. Among the gaseous bodies, this fact applies to oxygen and nitrogen, which from the great body of the atmospheric air in the proportion of twenty-one volumes of the former to seventy-one volumes of the latter. Nitrogen enters largely into the so-called cyanogen compounds that are extensively used in the arts; but, in spite of the most zealous attempts to separate it directly from the atmosphere, chemists still have to resort for their nitrogen to woolen rags, old leather, hoofs and coifs of horses, etc., materials rich in the substance. In regard to the oxygen, the problem of its cheap separation may now be considered as having been solved; indeed, I may say a magazine of about 200,000 billions pounds of this gas has been opened for use in the industrial arts. This discovery is due to an enterprising Frenchman, Mons. Tèssie du Môtay. It is of importance in this, that oxygen may now be advantageously employed in the manufacture of chemicals, in smelting and refining operations, as well as for the production of the oxy-hydrogen illumination. Oxygen is already employed in the manufacture of sulphuric and nitric acids which enter, as it were, either directly or indirectly into almost every chemical process. And it is to be hoped that oxygen will become indispensable for many metallurgic operations, which are now carried on with the employment of atmospheric air. The works in question were, however, erected with special regard to the oxy-hydrogen illumination—*lumière oxyhydrique*—which is creating, at the present time, a good deal of comment.

The Oxygen Gas Works of New York are situated on Forty-first Street, near Eleventh Avenue. They cover an area of 20,000 square feet, and, in their present extent, are capable of producing

from 25 to 30,000 cubic feet of oxygen in the space of twenty-four hours. The process is founded upon the fact that the manganate of soda gives off a part of its oxygen when steam is passed through the same red heat, and that it re-absorbs oxygen, when atmospheric air is passed through it. This process may be represented by the following formula:

$2 (\text{Mn O}_3, \text{Na O}) (\text{manganate of soda}) \times 2 \text{ H O (water)} = \text{Mn O}_3$
 (oxide of manganese) $\times 2 \text{ Na O, H O (hydrated soda)} \times 3 \text{ O (oxygen)}$.

According to this formula, the manganate of soda is capable of producing fourteen and a half per cent. of oxygen in weight, and since the oxygen is 737 times lighter than water, from one hundred pounds of the crude product there can be generated 1,348 gallons of oxygen, or something over five cubic metres.

The manganate of soda is heated in retorts of cast iron placed horizontal, of one inch in thickness. They are six feet long and two feet in diameter. The furnace is a peculiarly constructed reverberatory, and contains six retorts on each side, or twelve in all. Each retort holds nine hundred pounds of manganate of soda, but since it would fuse if pure, it is mixed with a certain quantity of the oxides of copper and manganese. In this state it presents the appearance of ordinary bone-black.

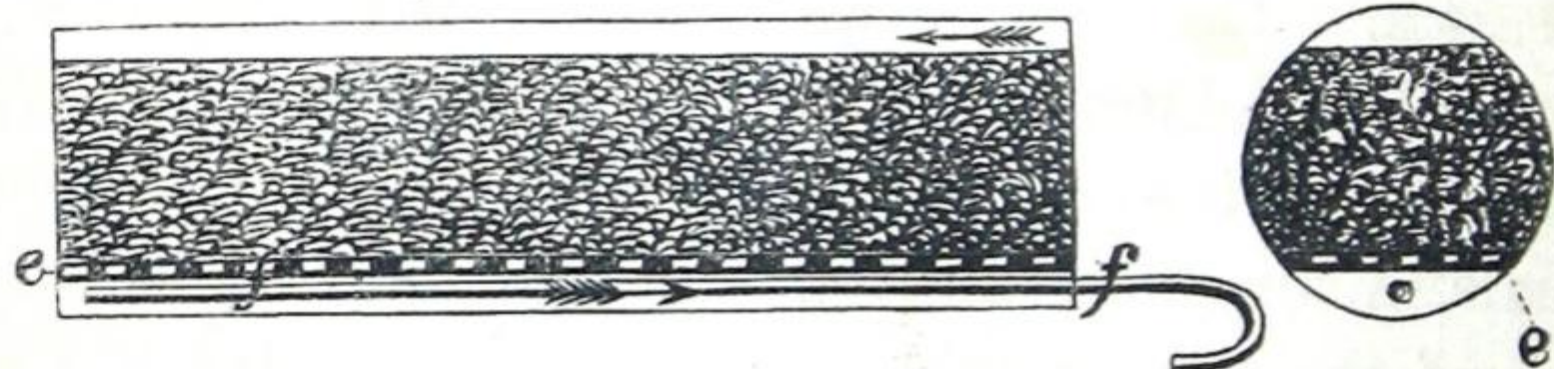


Fig. 1.

Fig. 2.

Fig. 1 represents a longitudinal section of one of the retorts; Fig. 2 a transverse section of the same. The material furnishing the oxygen is represented by the dotted part, and is represented lying upon the grate. The steam or air is conveyed into the upper part of the retorts; and after having passed through the material, it comes out at the point (o), and from there it is conveyed in the direction of the arrow through the hollow tube (f). The latter has a diameter of three inches. The retorts are brought to a cherry-red heat. After being filled, they do not require to be emptied again, as the material can be used *ad infinitum*. While steam is being conveyed through the six retorts on one side, air is

passing through the six on the other, so that the furnace yields oxygen constantly. Each operation lasts ten minutes. The steam is generated in an ordinary boiler, its pressure being kept at ten pounds per square inch. There are superheaters on both sides of the furnace, one for air and one for steam. Through these either air or steam is conveyed before they are made to pass into the retorts. They consist simply of U pipes of cast iron, having a diameter of four inches, and a length of seven feet from one elbow to the other. There being six U pipes on the one side of the furnace, the total length of the pipes in one superheater amounts to eighty-four feet. The thickness of the cast iron itself is half an inch.

The air is forced into the retorts by means of a pump, which is set in motion by an engine; it is first deprived of its carbonic acid by passing through a solution of caustic soda or potassa. In passing through the manganate the air is deprived of the greater part of its oxygen, while nearly pure nitrogen escapes. When the material is charged with oxygen, and steam passed through it, some steam will be mingled with the oxygen, that leaves the retorts. This is freed from the steam by conducting the mixture through a vessel, in which a fine spray of cold water is injected. Here the steam condenses, while the oxygen is conveyed in a gas-holder. Three men are all that the works require, one for attending the engine and the steam generator, one for managing the fire, and one for shutting off the air and steam alternately.

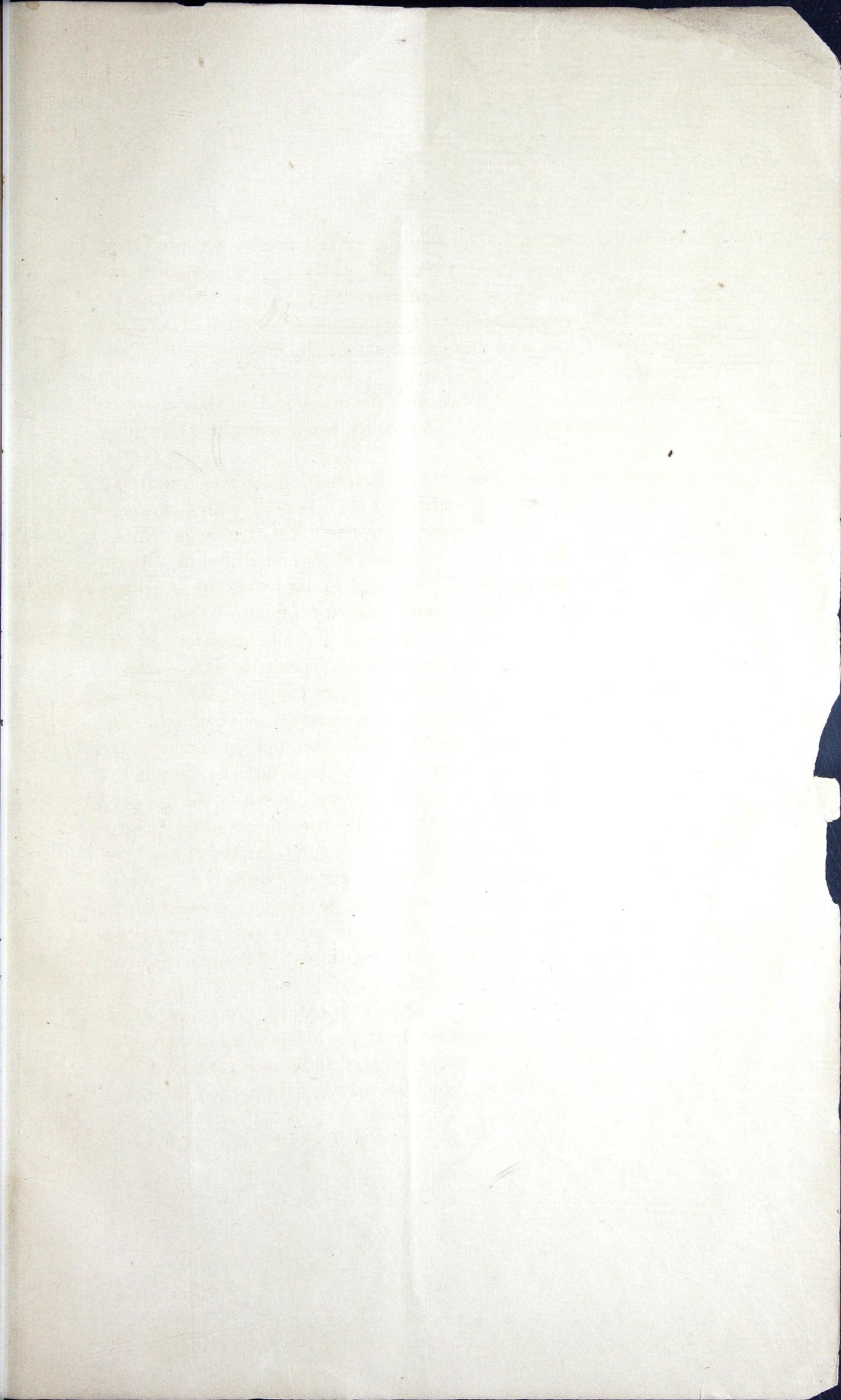
The operation is exceedingly simple, and although in Paris works have been in operation for six months, not the least diminution of the original property of the manganate, absorbing and yielding oxygen, can be perceived; nor has it been found that the retorts have become oxydized. It has been asserted that if the manganese oxydizes, so will the retorts in which it is treated, and likewise all the pipes and connections thereto. Now, if this were really so, it would be very unfortunate for the Bessemer process, in which atmospheric air is conveyed through *molten* cast iron; but the fact is, that in this case only the carbon is burnt. As the temperature of the cherry-red heat is about 2,000 degrees lower than that of the fusing point of cast iron, it follows that there can be very little

danger of oxydization. The above described process for producing oxygen distinguishes itself from all others by its economy and practicability; indeed, it may unreservedly be asserted that the long searched for problem for the economic production of this gas on a large scale has been more than solved, in the most perfect and satisfactory manner.

With respect to the application of oxygen in the arts, trials on the most extensive scale are at present being made in Communs, near Lille, in France.

With regard to the oxy-hydrogen illumination: It was introduced three months ago on the grounds of the Tuilleries, (which comprise an area of 30,000 square metres), into the "Theatre de la Gaite," and in the Alcazar, in Paris. It is also being introduced in Vienna. As to the illuminating power, it is said to be seven times greater than that produced by an equal quantity of street gas. The crayons or cones of zircon, which serve for the emission of the illuminating rays, have proved to be far superior to either lime or magnesia, and if pressed sufficiently they are neither liable to crack or break. Only those ignorant of the science of chemistry will assert that they will disappear as would the diamond, under like conditions. We may call attention to the fact that the diamond is an elementary substance, a metalloid which assumes the gaseous form upon uniting with oxygen, while zircon, as used in the oxy-hydrogen illumination, consists of a solid, earthy body, not capable of being brought to a higher state of oxidization. As to the price of the oxygen: it is furnished to the gas companies in Paris for twenty-five centimes (five cents gold) per cubic metre, while to private persons for seventy centimes. The inventor and patentee of the process is a gentleman of highly scientific attainments, and the originator of a series of chemical processes, which have all met with complete success. He is, indeed, one of the most successful inventors of the day. We are informed that several of the public places in New York will shortly be illuminated by means of this new light.

Engineering and Mining Journal, Sept. 28, 1869.



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